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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/796,442	03/09/2004	Mark T. Swihart	19226/2282 (R-5782)	1817

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EXAMINER	
SARKAR, ASOK K	

ART UNIT	PAPER NUMBER
2891	

DATE MAILED: 08/15/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/796,442	SWIHART ET AL.	
	Examiner	Art Unit	
	Asok K. Sarkar	2891	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *03 July 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-36* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *1-27,35 and 36* is/are allowed.

6)☒ Claim(s) *28-34* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *09 March 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

1. Claims 28 and 31 are objected to because of the following informalities: The phrase "photoluminescent free silicon nanoparticles" is misleading and is suggested to be written as "free silicon nanoparticles which are photoluminescent". Appropriate correction is required.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

4. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was

not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 28 – 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Seraphin, "Influence Of Nanostructure Size On The Luminescence Behavior Of Silicon Nanoparticles Thin Films," J. Mater. Res., Vol. 12(12), p 3386 (1997).

Regarding claims 28 and 29, Seraphin teaches that acid etching of thin films of agglomerated silicon nanoparticles with a hydrofluoric acid and nitric acid solution can be used for the benefit of shifting the luminescent peak in the abstract of their adicle in page 3386. Seraphin teaches removing the oxide layers from the silicon nanoparticles with HF and HNO_3 solutions to reduce particle size and alter photoluminescense in the experimental part in column 1, page 3387 and Fig. 1.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention that the acid treatment that removes the oxide layer of silicon nanoparticles in thin film will also be able to provide the same benefit to free powders.

Regarding claim 30, Seraphin teaches the acid solution comprises about 0.5% to 20% hydrofluoric acid and about 10% to 40% nitric acid in column 1 of page 3387 under the heading "Experimental Apparatus".

Regarding claims 31 – 34, Seraphin teaches treating the photoluminescent thin films of agglomerated silicon nanoparticles with an oxidizer such as 20 – 40% nitric acid solution under conditions effective to achieve particle surface oxidation in column 1 of

page 3387 under the heading "Experimental Apparatus" and Fig. 1 as was described earlier in rejecting claims 28 – 30.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention that the acid treatment that forms the oxide layer on silicon nanoparticles in thin film will also be able to provide the same benefit to free powders.

Allowable Subject Matter

6. Claims 1 – 27, 35 and 36 are allowed.

7. The following is an examiner's statement of reasons for allowance:

Claims 1 – 26 recite, inter alia, a process for producing photoluminescent silicon nanoparticles comprising reacting a silicon precursor in the presence of a sheath gms with heat from a radiation beam under conditions effective to produce silicon nanoparticles and acid etching the silicon nanoparticles under conditions effective to produce photoluminescent silicon nanoparticles. The art of record does not disclose or anticipate the above limitation in combination with other claim elements nor would it be obvious to modify the art of record so as to form a device including the above limitation.

Claim 27 recites, inter alia, a process for producing photoluminescent silicon nanoparticles comprising thermally decomposing a silicon precursor in the presence of a sheath gas with CO_2 laser radiation under conditions effective to produce silicon nanoparticles and acid etching the silicon nanoparticles with a hydrofluoric acid and nitric acid solution under conditions effective to produce photoluminescent silicon nanoparticles. The art of record does not disclose or anticipate the above limitation in

combination with other claim elements nor would it be obvious to modify the art of record so as to form a device including the above limitation.

Claim 36 recites, inter alia, a process for stabilizing photoluminesce in silicon nanoparticles comprising treating photoluminescent silicon nanoparticles under conditions effective to produce photoluminescent silicon nanoparticles having a Si – H terminated surface; and treating the Si – H surface – terminated nanoparticles under conditions effective to achieve particle surface hydrosilylation. The art of record does not disclose or anticipate the above limitation in combination with other claim elements nor would it be obvious to modify the art of record so as to form a device including the above limitation.

Claim 37 recites, inter alia, a process for stabilizing photoluminesce in silicon nanoparticles comprising treating photoluminescent silicon nanoparticles under conditions effective to produce photoluminescent silicon nanoparticles having a Si – OH terminated surface; and treating the Si – OH surface – terminated nanoparticles under conditions effective to achieve particle surface silanization. The art of record does not disclose or anticipate the above limitation in combination with other claim elements nor would it be obvious to modify the art of record so as to form a device including the above limitation.

Response to Arguments

8. Applicant's arguments filed July 3, 2006 have been fully considered but they are not persuasive. The arguments regarding claims 35 and 36 are moot. The arguments related to rejection of claims 28 – 34 are provided above. The same process that

applies to the particles in a thin film form will also apply to free particles since in the film the particles are agglomerated. Particles will be able to easily react with the acid when they are free flowing and loosely bound. Therefore the argument pertaining to these claims are not persuasive.

Conclusion

9. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

1. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

2. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Asok K. Sarkar whose telephone number is 571 272 1970. The examiner can normally be reached on Monday - Friday (8 AM- 5 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, William B. Baumeister can be reached on 571 272 1722. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

3. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Asok Kumar Sarkar
Asok K. Sarkar
August 7, 2006

Primary Examiner